PARTICULAR ELECTRICAL REQUIREMENTS

INTRODUCTION

The specific design and performance requirement for all electrical equipment are given in this part of the Specification. The requirement specified shall be fully met with by the Contractor. In case of any deviations, the Contractor shall bring out the same in "Schedule of Deviations from Particular Requirement" failing which it will be considered that the Contractor fully complies with these requirement. General Requirement of electrical equipment is covered under Part-6 of this specification. Tender drawings will be provided for **reference purpose only**.

PRIMARY POWER SOURCE

The electrical power supply required for the ISPS shall be derived from the nearby BESCOM substation. 2 Nos. of incomers (preferably each incomer from different substation to have redundancy) shall be derived through 11kV overhead lines or underground cables whichever is feasible. The BESCOM will be making necessary modification in their substation for providing the power supply to proposed ISPS, laying of lines/cables up to the ISPS substation location. Necessary metering unit will be provided by BESCOM. **This work will be done by BESCOM and will be executed under provisional sum. Contractor shall coordinate with concerned authorities for carrying out the above works. Necessary assistance wherever required shall be provided by the employer in executing these works.**

The Contractor's scope for ISPS starts with the proposed ISPS substation and shall cover all equipment/items as given above in the Scope of works.

BESCOM Scope of works

- All works related to modifications in their substation for providing 2 nos. of incomers.
- Laying of cables/providing overhead line from their substation till the incoming side of metering unit including metering unit at ISPS premises.

Contractor scope

- Laying of cables/ providing overhead line from the outgoing side of metering unit.
- Construction of ISPS substation which includes transformers, LT Room, HT Room, DG Room and further downstream works as per the scope of works.

The ISPS Contractor's scope includes liasoning with BESCOM for getting construction power supply, making permanent new power supply agreement (including necessary modifications in the BESCOM substation, laying of cables etc.) for the plant and getting final clearance from CEIG for complete Electrical system.

The contractor shall have to execute the works as desired by the Electrical Inspector or Engineer Incharge in order to make installation conforming to latest CEA regulations (measures related to safety & electric supply).

POWER SUPPLY ARRANGEMENT

The power supply scheme and distribution described below is **for reference only**. The tenderer shall prepare his own design calculations, conduct detailed engineering and prepare drawings to make his own estimate of quantities for entire electrical system.

Power Requirement

The estimated working load for ISPS Load is mentioned below

Working Load = 231.5kVA

Main Power Supply Scheme

Outgoing side of the HT meter shall be connected to the 11 kV Switchboard through 11kV Underground Cables. The 11kV Switchboard shall have 2 Nos. Outgoing feeders, which feeds power to 2 Nos, 11/0.433 kV Transformers through 11kV underground cables.

LT Distribution

- The LT side of the 11/0.433 kV Transformers, which will feed the proposed ISPS loads through 415V Main PCC (Loc: HT cum PCC panel room).
- 415V PCC shall have provision for 2 Nos. of Transformer incoming & 1 No. of DG incoming with required interlocking.
- All main motors shall have independent VFD starter panels and shall be located in the 415V switchgear room near the pump room.

GENERAL DESIGN CRITERIA ISPS

(a) The design standards described herein are generally in compliance with the latest Indian Standards, and code of practices already established in the country.

(b) All electrical installations shall conform to the latest Indian Electricity Acts and Rules.

(c) All electrical equipment shall be rated for 45^0C design ambient temperature.

(d) Explosive Atmosphere (Applicable in areas like DG etc):

(i) The following factors shall be considered for proper selection of electrical apparatus or equipment for areas where flammable gas or vapours may rise.

(ii) The classification of area shall be as per IS 5571 & IS 5572, based on the degree of probability with which explosive concentrations of combustible gas or vapour may arise in installations in terms of both the frequency of occurrence and probable duration of existence on each occasion.

- Zone 0 – In which an explosive gas/air mixture is continuously present or present for long periods.
- Zone 1 – In which an explosive gas/air mixture is likely to occur in normal operation.
- Zone 2 – In which an explosive gas/air mixture is not likely to occur in normal operation and if it occurs, it will exist only for short periods.

(iii) <u>Gas Group Classification:</u>

The characteristics of the gas or vapour involved in relation to Igniting current or minimum ignition energy in case of installations of intrinsically safe apparatus or maximum experimental safe gap data in case of installations for flame proof enclosures as per IS 2148.

(iv) <u>Temperature Classification:</u>

The Ignition temperature of the gas or vapour involved, or the lowest value of ignition temperature if more than one combustible material is present. The maximum temperature of any unprotected surface of electrical equipment shall not exceed the Ignition temperature of gas or vapour.

(v) For electrical apparatus, no margin of safety need be applied between maximum surface temperature and ignition temperature. The Ignition temperature of combustible gases and vapours are measured in accordance with the test method prescribed in IS 7820.

(vi) Environmental conditions in which the apparatus is installed. Apparatus and its component parts shall be constructed so as to guard against electrical and mechanical failures in the intended conditions of use.

(vii) The selection of type of protection of electrical equipment for the different zones of Hazardous areas shall be made in accordance to Clause 6, Table -1 of IS 5571. All electrical equipments installed in hazardous areas shall confirm to selection of equipments and installation guidelines of IS 5571.

(e) **11kV System**

a) Nominal voltage	:	11kV
b) Number of phases	:	3
c) Frequency	:	50 Hz
d) Connection	:	3 Wire
e) Maximum Fault Level	:	500 MVA
f) Fault Current	:	26.2 kA

(f) **LV System**

a) Voltage:	:	415 V nominal
b) Frequency:	:	50 Hz
c) Connection	:	4 wire
d) No load transformer voltage	:	433 V
e) System earthing	:	Solidly earthed
f) Maximum fault level	:	36 MVA
g) Fault Current	:	50 kA

Plant shall, unless otherwise specified, be capable of continuous operation at a voltage level in the range of 90% to 110% of the relevant nominal voltage and a frequency variation of ±5% with a maximum combined tolerance of 10%.

(g) **AC Control, Lighting and Space Heating**

a) Voltage:	:	240 V
b) Phases:	:	1
c) Frequency	:	50 Hz
d) Connection	:	2 wire (Phase & Neutral

(h) **DC Control, Protection and Alarm**

a) Voltage:	:	110 V
b) Phases:	:	1
c) Connection	:	2 wire (unearthed

11kV INDOOR SWITCHBOARD

(a) 11 kV switchgears/ MCC shall be sheet metal enclosed with draw out type vacuum circuit breakers for incoming and outgoing feeders, control and protection for the HV motors and auxiliary transformers.

(b) The switchboard shall be rated for a fault current not less than 26.3 kA (rms).

DISTRIBUTION TRANSFORMERS

(a) The transformers shall be out door type, ONAN, 11/0.433 kV, 3 phase, 50 Hz, two winding, Dyn11 with solidly earthed neutral.

(b) The transformers shall be sized considering minimum 10% contingency of total working load while arriving at the final capacity of transformers.

(c) Two numbers of transformers shall be provided such that under normal condition, each transformer will be loaded up to 50% and in case of failure of any one transformer, the healthy transformer shall have capacity to take entire load so as to have 100% standby.

(d) The transformer shall be designed such that at any point of time maximum loading on any single transformer shall not exceed 85% of full load capacity.

ENERGY EFFICIENT INDUCTION MOTORS

(a) Motors shall be suitable for

1	Motors rated upto 355 kW	LT Supply
2	Motors > 355 kW	HT supply

(b) The motors will be of Reputed and Reliable make and the same will be subject to approval of client’s representative.

(c) The Degree of Protection of Terminal Boxes of all Outdoor Motors shall be IP55.

(d) All the stator winding terminals of the induction motors shall be brought out up to the terminal box.

(e) All LT motors are required to be TEFC type with class ‘F’ insulation. Outdoor type Motor shall be with IP55 degree of protection and indoor shall be IP54. LT energy efficient motors shall be as per IS 12615 & IEEMA 19-2000 and shall have Efficiency Class equal to IE-2 as per IS 12615: 2011.

SYSTEM PROTECTION

Numerical relay based protection system for various parts of the power supply system are proposed. The following protection systems shall be used:

(a) 11 kV System

11 kV Incomer Feeder

- Inverse definite minimum time phase over current protection;
- Inverse definite minimum time earth fault protection.
- Under voltage Relay

11 kV Outgoing Feeder

- Inverse definite minimum time phase over current protection
- Inverse definite minimum time earth fault protection.

(b) 415V System

415 V Incomer Feeders

- Over current & Earth fault protection;
- Under voltage relay.

LV Motors

Motors less than 15 KW

- Single phasing preventor.
- Motor Protection Circuit Breaker

Motors above 15kW up to 100kW

- MCCB with separate bimetallic overload relay and single phase preventer.

Motors 100kW and above

- Comprehensive motor protection relay providing the following protection:
- Thermal Overload;
- locked rotor;
- Phase Over current (50/51);
- Earth fault (50N/51N);
- Over voltage & under voltage;
- phase loss/reversal;
- Negative sequence;
- Protection for repeated and prolonged starts;
- restart inhibition;
- Single phasing preventor;
- MCCB

(c) Pump Drives

All pumps shall be provided with the following additional protection, as per requirement:

- Dry run protection;
- Temperature protection (Submersible pumps)
- Moisture entry protection (Submersible pumps)
- Over pressure (positive displacement pumps)

(d) Blowers

Blowers shall be provided with the following additional protection:

- Over pressure

(e) Rotating Arm Drives

Rotating arm drives shall be provided with the following additional protection:
Motion detectors;

- Over torque detectors.

(f) Valve Actuator Drives

Valve actuator drives shall be provided with the following additional protection:

- Over torque detectors.

SWITCHGEAR EQUIPMENT / INSTRUMENTS

(a) 11 kV Feeders

- Analog Ammeter for all 3 phases
- Analog Voltmeter selector switch
- Digital Multifunction meter with RS 485 connectivity

(b) 415V Incomer Feeders

- Analog Ammeter with selector switch
- Analog Voltmeter with selector switch
- Digital Multifunction meter with RS 485 connectivity

(c) 415V Motor Starter Feeders

- Analog Ammeter with selector switch
- MFM meters for Motor feeders for main motors
- DOL Starters for motor feeders less than or equal to 5.5 kW
- Star-Delta Starters for motor feeders above 5.5 kW and upto 100 kW
- Line/Neutral Soft Starters for motor feeders above 100 kW.
- Soft Starter for main motors.

STANDBY DIESEL GENERATOR SETS

(a) The Standby Diesel Generator Sets shall be complete with Acoustic Enclosure.

(b) The contractor shall size the DG considering 50% of the working plant load in the event of power failure without affecting the discharge parameters. The DG Set shall be sized with minimum 10% Contingency Capacity.

(c) In case of mains failure detected by an under-voltage relays mounted on bus of the AMF panel, the standby generator starts and after the generator set reaching the rated speed and rated voltage, the generator circuit breakers will be switched on to feed Diesel Generator power to the panel. On restoring main supply, the reverse sequence of the above will be followed for the mains supply to feed power to the loads as in normal condition.

415 V PCC / MCC

(a) 415V PCC/MCC & 415V DG PCC shall be Single front, floor standing, top cable entry, sheet steel enclosed with IP 54 Degree of Protection, Form–IV enclosure as per IS/IEC 61439 complete with Air circuit breakers/MCCB's /MPCBs, Control & Protection. The PCC / MCC shall be rated for a fault current not less than 50kA (rms) for 1 sec.

(b) Double front construction may be acceptable only in case of space restrictions in the Electrical Room and for motor starter feeders and small feeders (below 630A).

(c) All feeders of ratings 800A and above shall be ACB type. Feeders below 800A and upto 63A shall be MCCB. Ratings below 63A shall be MCB. Motor feeders upto 15kW shall be with MPCB.

In general, all switchgear/MCCs shall be provided with 20% fully equipped spares feeders/breakers.

(d) All Motor Feeders in the MCC Panels shall have Contactors, Start Stop Push buttons, OLR Reset button and ON-OFF-Trip indication.

(e) All Motors the MCC Panels shall be provision to operate from both PLC & MCC.

(f) Emergency Stop push button shall be provided near the motors.

(g) All door locks shall be provided with special keys to ensure opening by authorized personal only.

(h) Earth bus-bar shall be extended outside the switchboard at the ends.

(i) Panel height shall not be more than 2300 mm (Including 100mm base ISMC if it is pedestal mounted). The depth of panel shall not exceed 1350mm & any

operating handle of switchgear shall not be more than 1800 mm and not lower than 300 mm from base of the panel. Substation/MCC/Switchgear/ Electrical building shall have at least 3 mtrs clear room height.

(j) The exposed bus live parts in the cable alley shall be totally covered against accidental contact by a shroud (and not by sleeve) to protect the workmen working on the switchgear.

OPERATION LOGIC OF SWITCHGEARS

Operation Logic of 415V Metal Enclosed Switchboard at Substation:

- At normal condition, both the Incomers shall be in Closed Position and the DG Incomer & Bus coupler shall be in Open Position.
- If any Incomer fails the faulty Incomer shall be in Open Position, the Bus coupler and the healthy Incomer shall be in Closed Position.
- In Case of Power Failure, DG Incomer & Bus coupler shall be in Closed Position and the Mains Incomer shall be in Open Position. The critical loads of the plant shall run on DG Set.

POWER FACTOR

The LT capacitor banks provided shall be of bus connected type with Automatic Power factor correction, the system shall be designed such that a power factor of not less than 0.98 shall be maintained.

Automatically controlled multistage power factor correction shall be provided. 2 Nos. PFC panels providing no less than 8 number PFC stages per panel shall be provided each connected to one bus section of the LT Switchboard. The PF on each bus section of the board shall be monitored and corresponding PFC capacitors switched in and out automatically in discrete stages to maintain a set point PF value.

Each panel shall be configured such that no PFC capacitor stages operate when the standby generator powers the side of the distribution board to which it is connected. Reactors shall be provided for the protection of capacitors.

MCCBs, Switches, Contactors shall be suitable for making and braking current of the capacitors. The Panels shall be floor standing, sheet steel enclosed with relevant degree of Protection. APFC/Capacitor control panel shall be suitable for top cable entry.

DC POWER SUPPLY

(a) 110V DC system is envisaged for protection and controls of 11kV control and relay panel.

(b) DC Power supply shall be provided for Trip / Closing coils, Indications etc. of 11kV and 415V Switchgears.

(c) Local circuit breaker shall be provided for batteries.

(d) The batteries shall be 110V, maintenance free and shall be complete with battery, battery charger with boost & trickle charging facilities, necessary controls, indications and DC distribution board.

(e) The battery room shall be provided with acid proof tile flooring, corrosion proof lighting fixtures, exhaust fans and wash basin.

CABLING

a) HV Power Cables

HV cables shall be 3 core, 11kV (UE), XLPE type with stranded aluminum conductors & GI armouring. Minimum size of cable shall be selected based on the short circuit considerations.

b) LV Power Cables

LV power cables shall be 1.1 kV XLPE type with

- Stranded Copper Conductors with GI armouring for sizes below 6 sq.mm.
- Stranded aluminum conductors with GI armouring for sizes 6 sq.mm and above.

No. of cores shall be as per requirement.

c) Control cables

Control cables shall be 650/1100V, PVC with stranded copper conductors and GI armouring. Number of cores shall be as per requirement. Minimum size of core shall be 1.5 Sq.mm.

d) Cable Rating

All power cables shall be sized for continuous current carrying capacity and permissible voltage drop at an ambient temperature of 45 ^{0}C. Due consideration shall be taken of cable grouping, method of installation and local variations in ambient conditions.

Further, for cables controlled by circuit breakers, due consideration shall be given to the fault level.

MV and LV cables shall be sized for a minimum fault clearance time of

- 1 second for incoming feeders
- 0.5 second for tie feeders
- 0.25 second for motor feeders

- 0.16 second for transformer feeder

For all LT Cables, the voltage drop in the cables between the transformer and the switchgear (PCC) or between PCC and MCC for full load current shall be limited to 2%. Further the voltage drop in cables between PCC/MCC to Motor terminals for full load current shall be limited to 3%. The total Voltage drop transformer secondary to motor terminal shall be limited to 5%.

Under motor starting conditions the corresponding voltage drop shall not affect the operation of the motor controls or the ability of the motor to start and run effectively and in any event shall not exceed 15%.

e) Cable Installations

Inside the electrical room/substation/Building/Pump House (Except buildings like Office/Employers Bldg./Guard Room/Admin Bldg.)

Cables shall be routed on overhead cable tray with heavy duty galvanized iron cable tray (in chlorine, chemical and other corrosive areas, FRP/GRP type cable tray shall be used) and ladder racking shall be used for cable support systems with recommended bending radius as per relevant BIS standards. Cable trays shall be used to route cables along walls, below beams and within cable trenches. Cable trays shall be sized considering 20% margin. Cables shall be securely fixed to the support systems. Bundling of cables shall be permitted where allowance for this practice has been made while sizing the cables.

Inside the buildings like Office/Employers Bldg./Guard Room/Admin Bldg.

Cables shall be routed in conduit. Separate conduits shall be used for lighting circuits, power circuits & fan circuits. Separate conduits shall be provided for routing of wires of different phases.

Outside the Building/Pump House

All cable installations outside the plant area upto the building entrances shall be done in direct buried underground cable trenches as per IS 1255/NEC 2023. Necessary cable pull pit shall be provided at the entry/exit points of the building.

Road Crossing

Cables at road crossing shall be installed in RCC Ducts with a minimum cover of 1000mm from top of road level. There shall be cable pull pits connecting the RCC duct at either ends of the road crossings.

Street / Road Lighting

All cable installations for street / road lighting shall be direct buried underground cable trenches as per IS 1255/NEC 2023 at minimum depth of 750mm.

f) Cables of different categories shall be installed in separate trays and maintain satisfactory clearances for safety and to reduce the possibility of electrical interference. The following Table details the distances in mm that shall be maintained between the different categories of cables.

Table 12.1: Separation Distances between different Categories of Cable

Cable Category	HV Power	LV Power	C&I/ Protection	Telecom
HV Power	N/A	300	600	600
LV Power	300	N/A	300	300
C&I/ Protection	600	300	N/A	100
Telecomm	600	300	100	N/A

g) Cable Numbering

All cables shall be allocated a unique number which will be fixed to each end of the cable using a corrosion resistant label. Cables of different categories will be tagged with the following subscripts and a three digit number.

- HV power HV-P_ _ _
- LV power P_ _ _
- Control C_ _ _
- Instrumentation I_ _ _
- Protection PR_ _ _
- Telecommunication T_ _ _

BUILDING SERVICES

a) Lighting

The lighting system work shall conform to the requirements of relevant code of practice, and drawings enclosed with specification.

All plant internal and external areas shall be provided with energy efficient light fittings. The illumination levels to be achieved shall be as follows:

Table 12.2: Illumination Levels

Sr. No.	Area	Min. Lux Level
1.	Offices	300
2.	Control Room / SCADA Room – General	300

Sr. No.	Area	Min. Lux Level
	Lighting	
3.	Laboratory	300
4.	Indoor Electrical substation, DG Room, Blower & Pump rooms	200
5.	Battery Room	150
6.	Machinery service area	200
7.	All other indoor areas	100
8.	Outdoor platforms and walk ways	50
9.	Building entrance	100
10.	Outdoor plant areas	20
11.	Outdoor transformer yards - General - On equipment	 20 30
12.	Street lighting	20
13.	Emergency Lighting	

Emergency Lighting shall be provided with self contained chargeable type emergency luminaries in internal premises as per requirement. These luminaries shall automatically illuminate in the event of a power failure and provide a minimum level of lighting for approximately 3 hours. They shall automatically recharge on the return of mains power.

The outdoor lighting fittings shall be weatherproof, dustproof and corrosion resistant with IP 65 protection class.

The main entrance to the building, structures, all external area/ road/ pathway and site where required, shall be provided with appropriate external lighting.

For area lighting, Building structures shall be used as a support for installation of fixtures.

Outdoor/ street lighting shall be provided with photocell & timer controls, with manual override facilities.

Wiring:

i) Wiring for lighting in office & pumping station internal areas will be done with 1.1kV, PVC insulated, stranded copper conductor wires of area not less than 2.5 sq mm in concealed conduits.

ii) Lighting in external areas shall be installed using multicore armored cable.

b) Ventilation Fans

Variable speed ventilation ceiling fans & exhaust fans shall be provided in offices and switchgear rooms as per requirement. One Ceiling fan of 48" size shall be provided for each 10 Sq.mm or part thereof of the area concerned. The supply to these fitted ceiling fans shall be provided from the local lighting circuit.

c) Small Power Outlets

Switched single phase three pin 6 A and 16A receptacles shall be provided throughout. In offices and control rooms they shall be modular decorative type and industrial type in all other areas for single and three phase sockets. All outlets for domestic pump, dewatering pump, submersible sump pump shall be provided with local starter panel or control cubicle. All metal clad sockets shall be provided with suitable metal clad plug. All socket outlets shall be provided with ELCB/RCCB at the source side.

Unless required to be provided in greater numbers to power specific Plant items the number of such outlets shall be as follows:

- 6 A type one outlet per 5 m or part thereof of perimeter in offices and laboratories;
- 6 A type one outlet per 20 m or part thereof of perimeter in all other areas;
- 16 A type one outlet per 20 m or part thereof of perimeter in offices and laboratories;
- 16 A type one outlet per 20 m or part thereof of perimeter in all other areas.

30 A switched (MCB) three phase and neutral receptacles shall be provided in plant areas where appropriate i.e. adjacent to areas where flooding is likely (to permit the use of portable sump pumps) or where other portable equipment is likely to be used in the operation of the treatment plant. The Contractor shall install ten such outlets at various locations throughout the treatment plant.

The location of outlets shall be approved by the Engineer. The spacing of 6A and 16A outlets shall be arranged to suit the intended location of equipment, desks etc. Receptacles for outside areas shall have a degree of protection of IP 55.

EARTHING & LIGHTNING PROTECTION

a) The earthing system shall be designed according to IS 3043, NEC 2023, NBC 2016, IEEE 80, BS 7354, 7430 or relevant IS/IEC standards.

b) Earthing system shall be a designed arrangement of an interconnected mesh of suitable size of earth conductors and electrodes buried below ground at the depth mentioned in IS 3043-2018 and connected to all the metallic exposed and

accessible to humans but not intended to carry normal current, parts of the equipment which are vulnerable to live accidentally, which would cause irreparable damage to the equipment and danger to human life, if remain live at high potential beyond a certain safe period.

c) Earth grid shall provide

- An equipotential surface to limit the potential gradient at the Earth's surface.
- A low impedance path for the fault current to the earth, thereby avoiding a rise of potential to a dangerous level and ensuring fast clearance of earth faults by protective devices.

d) An earthing system comprising earth electrodes and conductors shall be established separately for each building / structure and these networks shall be interconnected.

e) Earthing installation inside a building shall be carried out by equipotential bonding with Main Earthing Terminal (MET). All the external earthing terminals of the switchboards/distribution boards (or) MET of the switchboard/distribution board; all protective conductors of exposed conductive parts are connected to Main Earthing Terminal (MET). All extraneous conductive parts, incoming metallic service pipes, are also connected to main MET. Furthermore, this main MET is connected to earth electrodes via the Earth conductor, as per the design of the supply system.

f) The earthing system shall be designed to give a combined earth resistance value of not greater than 1 ohm. To ensure obtaining suitable final values, soil resistivity shall be measured and recorded at various site locations during the detailed design phase of the work.

g) In outdoor substation areas where the main earth electrode conductors will be located, ensure potential gradients occurring at the surface during fault conditions are kept within allowable limits.

h) In outdoor transformer yards, substations & switchyards, crushed rock (min. 10 cm) or gravels (50mm size) in entire area shall be provided to increase contact resistance between person's foot and earth surface and thus provide safer step and touch potentials.

i) Along with the main grid conductors, sub-grid conductors and risers for equipment earthing shall be prepared and laid at proper locations. Depth of the earthing conductor shall be at least 600mm below final grade level (FGL). Earthing conductors around buildings shall be buried at 1.5m from outer boundary of the buildings. In outdoor yards & switchyards, main earth conductor shall be buried 1.0 m outside the fencing perimeter.

j) Earth conductor entering a building at below grade level, water stop shall be provided to avoid any seepage of water inside the building. Connections from the earth grid to the equipment shall be made using short, direct leads that are free from kinks and splices.

k) Earthing conductor embedded in concrete shall have at least 50mm concrete cover. Earth conductor shall be passed through Hume pipes for road crossings.

l) Light fixtures, conduits, ceiling fans, switches, sockets, power receptacles, JBs, streetlight poles, panels shall be earthed with separate earth conductor. RCCB/RCD (30 mA sensitivity) shall be provided in lighting circuits.

m) Connection between main grid and equipment earthing grid and between main grid/sub-grid conductors shall be welded or brazed type. Steel to copper and copper to copper connections shall be brazed type. Steel to steel connection shall be done by electric arc welding with low hydrogen content electrode. For prevention of rust the welds or brazed connections shall be treated with Red Lead and thickly coated with black bituminous paint/compound. All brazing shall be done with oxy-acetylene torch flame.

n) Metallic sheaths, screen and armour of all multicore power/control cables shall be earthed at both, equipment, and source/switchgear ends.

o) Earthing of Computer and Electronic System: Safety earthing and zero signal reference ground should be provided for computer and electronic systems as per BIS code/approved specification/drawings.

p) Earth conductor crossing through wall or floor slab shall be routed in GI conduit or HDPE pipe sleeve. These sleeves shall be waterproof/bitumastic compound or by fireproof sealant.

q) Materials used for earth electrodes shall be designed to suit the ground conditions and shall be either plain mild steel or galvanized steel or copper coated steel.

r) All the electrical equipment, frames and mechanical apparatus shall be provided with designated grounding points. Cable trays and vertical runs shall be connected to earth grid at least 20-meter intervals.

s) The size of the earthing leads shall be dependent on the type of equipment, maximum let through ground fault current, fault clearing time of protective device connected to it.

t) The system shall be designed for the following maximum earth fault currents. These values shall be verified at detail design phase based on the short circuit calculations in ETAP software.

- 11 kV system 26.3 kA
- 415 V system 50 kA

u) The fault clearing time shall be considered as per IS 3043 with minimum one second for the 11 kV and 415 V systems.

v) The maximum temperature allowed for steel welded / brazed joints will be taken as 500 ^{0}C with an ambient of 45 ^{0}C. Main equipotential bonding conductors shall be galvanized steel.

w) Circuit protective conductors will comprise either the armouring of the supply cable or, for major loads such as main switchboards and large drives the supply cabling plus an additional suitably sized single core copper cable.

x) The neutral point of the 11/0.433 kV transformer secondary windings will be solidly earthed.

y) The need of lightning protection shall be established by calculating the overall risk factor as per IS/IEC 62305.

z) Air termination system comprising of rods/mesh or combination of both shall be provided and the methods used to determine the positioning of Air termination system shall be as per IS/IEC 62305.

aa) Air termination system shall be connected to the earthing system by down conductors fixed along the outer surface of building. Number & layout of the down conductors shall be as per IS/IEC 62305.

bb) Each down comer will be terminated to a separate treated test earth electrode which in turn will be connected to plant earthing system.

cc) A test link will be provided at approximately 1000 mm above ground level for each down conductor during the run.

Others

All Electrical work design, installation, testing and commissioning shall be strictly followed as per

a) Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations 2023.

b) National Electrical Code of India 2023, part 1 section 22.

- A comprehensive power distribution schematic diagram for the entire plant area shall be prepared, and based on additions/ alterations, such diagrams should be updated from time to time.
- Premises like transformer yard, sub-stations, electrical rooms, pump house, generating rooms, etc. shall be kept clean, free from the growth of plant vegetation, storage of broken furniture, dismantled materials, waste material, packing boxes, etc.

- All premises like sub-station, pump house etc. to be maintained as protected area with admission allowed to authorized persons only. Also, the access of such areas shall be kept free and parking.
- No inflammable materials shall be stored in places other than the rooms specially constructed for this purpose following the provisions of the Indian Explosives Act.
- Rubber or insulating mats as per IS: 15652:2006 should be provided in front of the main switchboards or any other control equipment of medium voltage and above.
- Protective and safety equipment such as rubber gloves, earthing rods, safety belt, portable artificial respiration apparatus etc. should be provided in each sub-station, admin building, guard room and important installations. Where electric welding or such other nature of work is undertaken, goggles shall also be provided.
- Necessary number of caution boards such as “Men ON LINE”, “Don’t Switch ON” should be readily available in each sub-station, admin building and important installations.
- Standard first aid boxes should be provided in each sub-station, guard room and important installations and should be readily available.
- Periodical examination of the first aid facilities and protective and safety equipment provided at the various installations shall be undertaken for their adequacy and effectiveness and a proper record shall be maintained.
- Charts (English/Kannada) displaying methods of giving artificial respiration to a recipient of electrical shock should be prominently displayed at appropriate places.
- A chart containing the names, addresses and telephone numbers of the nearest authorized medical practitioners, hospitals, fire brigade and also of the officers in executive charge shall be displayed prominently along with the First Aid Box.
- Electrical wiring and control switches should be periodically inspected and any defective wiring, broken parts of switches which will expose live parts, should be replaced immediately to make the installations safe for the user.
- The electrical switchgears and distribution boards should be clearly marked to indicate the areas being controlled by them.

Fire fighting system shall contain but not to limited to, the items listed below –

- Portable fire extinguishers.
- Nitrogen injection fire prevention method for transformer as per latest NFPA/IEEE /CIGRE standards.

- Sand & Water Bucket.

TECHNICAL DATA SHEETS

12.19.1 11 KV/ 0.433 kV Distribution Transformers

	Description	Unit		Technical Particulars
	Rated output	KVA		As per the Requirement
	Quantity required	Nos.		Min. 2 Nos.
	Transformer location			Outdoor
	No load transformer ratio	kV		0.433
	Number of phases			Three
	Rated frequency	Hz		50
	Impedance at all taps			Value as per IS 2026/1180
	Number of winding/ material of conductor			Two/Copper
(a)	Method of connection HV winding			Delta
(b)	LV winding			Star
10	Vector group			Dyn 11
11	LV Neutral			Solidly earthed
12	Type of cooling			ONAN
13	Reference Ambient			45
14	Oil by thermometer			40
15	Winding by resistance			45
13	Tap changer			As per Specification
14	Tap range			As per Specification
15	Tap step			As per Specification
16 (a)	Terminal connection HV terminals			Cable box with air insulated disconnecting Chamber

		Description	Unit		Technical Particulars	
(b)		LV terminals			Suitable for connecting Bus Duct emanating from top side of transformer with neutral 100% rated	
17		Current Transformer			As per Requirement	
(a)		On LV				
(b)		On LV Neutral				
18		LV Neutral earthing			LV neutral bushing – part of bus duct as well as separate neutral bushing For earthing connection.	
19		Insulation of Windings			H.V.	L.V.
(a)		One minute power frequency withstand voltage (dry and wet)	kV (r.m.s)		28	3.0
(b)		1.2/50 micro second full wave impulse withstand voltage	kV (peak)		75	
20		Insulation of bushings			H.V.	L.V. (Line and Neutral)
(a)		Rated Voltage of bushing	kV		12	1.1
(b)		One minute Power frequency withstand voltage	kV (r.m.s)		28	3.0
(c)		1.2/50 microsecond full wave impulse withstand voltage	kV (peak)		75	-
(d)		Minimum Creepage distance	25mm/kV		on 12kV	25mm/kV on 1.1kV
21		Vacuum withstand capability of transformer main tank with bushings, radiations, fitting and accessories.			As per sprcification	

		Description Unit		Technical Particulars
22		**11 kV Cable Box** 11 cable box shall be provided on transformer towards right hand side of transformer with when viewed from H.V side. This will facilitate removal of transformer for maintenance without affecting 11 kV cable terminations.		
23		**Radiator Banks** Radiator banks shall be provided on transformer on left side when viewed from H.V side.		

11 kV Metal Enclosed Switchgears/ MCC

	Description		**Technical Particulars**
	Quantity		As per Requirement
	Switchgear cubicles and Busbar ratings		
(a)	Rated voltage, phases and frequency		11 kV, 3 Ph 50 Hz
(b)	System Neutral Earthing Effectively earthed / Non effectively earthed		Non-effectively earthed. Resistance earthed limiting earth fault current to full load current
(c)	Maximum system voltage		12
	One minute Power frequency withstand voltage		28
	12/50 μsec impulse withstand voltage		75
	Short circuit withstand (i) Short time (1 sec) at rated voltage		26.2
	(ii) Dynamic rating		62.5
	Reference ambient temperature		45^0C
	Maximum temperature of bus bars droppers connectors and contacts at continuous current rating under site reference ambient temperature		90^0C - FOR BUSBARS HAVING NON-SILVER PLATED JOINTS 105^0C - FOR BUSBARS HAVING SILVER PLATED JOINTS

	Continuous current rating of bus bar		As per the SLD
	Bus bar material		ALUMINIUM
	Bus bar Insulation		Fully insulated by encapsulation in epoxy resin with mould caps protecting all joints
	Cable entry		Bottom
	Cable type for Incoming and Outgoing feeders		11 kV XLPE unearthed Aluminium conductor

	Switchgear constructional Requirement			
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partitions			Frame – 2.5 Doors/Covers – 2.0
	Degree of protection			BUS BARS – IP3X, OTHERS – IP4X
	Colour finish shade			Interior - GLOSSY WHITE
				Exterior - Light grey semi-glossy shade 631 of IS:S
	Earthing bus	i) Material		Copper
				25 x 6 (*)
	Earthing conductor	i) Material		GS Flat
				50 x 10 (*)
	Breaker Particulars			
(a)	Circuit breaker type			Vacuum (With Surge Suppressor)
	Voltage, phases and frequency			12 kV, 50 Hz, 3 Ph
	Rated operating duty			O-3 MIN-CO-3 MIN-CO
(d)	Rated current at reference ambient temperature (i) Incoming breakers			As per the Requirement
	(ii) Outgoing breakers			As per the Requirement
(e)	Rated breaking capacity			26.2

(f)	Rated making current		62.5
(g)	Short time current withstand for 1 sec duration		26.2
(h)	Total break time		Less than 5 cycles
(i)	Operating mechanism type (Normal)		Motor Charged Spring.
	Operating mechanism type (Emergency)		Manual Spring Charged for closing and tripping
	Minimum no. of auxiliary contacts		6 NO+ 6 NC
	Withstand test voltage (i) One minute power frequency		28
	(ii) 1.2/50 μ sec impulse		75
	Auxiliary control voltage (i) For closing / tripping coil		110 V DC
	(ii) For spring charging motor		240 V AC
	(iii) For space heaters and lighting		240 V AC
(m)	Anti pumping feature		To be provided
	Latching requirement		Trip free
	Current Transformers		
	Type		Cast resin Bar Primary
(b)	Class of insulation		Class B or better
(c)	Rated current ratio and burden (i) Incomers and bus couplers		As per the Requirement
	(ii) Outgoing feeders Motor feeders – Protection		As per the Requirement
	(iii) Motor feeders – Metering		As per the Requirement
	(iv) Auxiliary Transformer feeder – Metering		Not Applicable
(d)	Accuracy class (i) Metering		MIN. CL 0.5/1.0

	(ii) Protection		MIN. 5P10
(e)	Short time 1 sec current rating kA (rms)		26.2
(f)	Dynamic rating (peak)		62.5
	Voltage Transformers		
(a)	Type		Cast resin
	Rated Voltage (i) Primary V		11000/√3
	(ii) Secondary – S1 V		110/√3
	Method of connection (i) Primary – P		Star, earthed
	(ii) Secondary – S1		Star, earthed
	Application – S1		Metering and protection
	Rated burden VA		As per the Requirement (should be capable to supply the whole panel if the PT on the other side of bus coupler not working)
	Accuracy class		Class B or better
	Rated voltage factor (i) Continuous		1.1
	(ii) Short time		1.5

	Meters		Digital/Analogue
	Accuracy Class (i) Indicating Meters		Class 1.0 or better
	(ii) Energy Meter		Class 1.0 or better
	Annunciations		
	Following alarm annunciation shall be provided on the respective 11 kV switchgear modules Incoming feeders (i) Incoming circuit breaker - trip (ii) Lockout relay - trip (iii) Bus section circuit breaker trip		
	Outgoing feeders (motor feeders) – Not Applicable (i) Motor trip on fault (ii) Motor winding temperature high alarm (iii) Motor winding temperature high trip		
	Other Outgoing feeder - trip		
	Spare windows	As per SLDs	
	Cubicle Components Each 11 kV circuit breaker cubicle shall be provided with the following minimum standard accessories		

One control switch ‘trip-neutral-close’ spring return to neutral position
One control selector switch ‘Local-remote stay-put’ type
Indicating lamps with series resistors (i) ‘Red’ for breaker in ‘On’ indication (this shall also supervise trip coil) (ii) ‘Green’ for breaker ‘Off’ position (iii) ‘Blue’ for breaker in ‘Service’ position (iv) ‘Amber’ for breaker in ‘Test’ position (v) ‘White’ for breaker closing spring ‘Charged’ Indicating lamps (iii), (iv) and (v) shall be provided when positive mechanical indicators for these conditions are not available/visible
Mechanical trip push button to trip the breaker when control supply is lost. The push button shall be shrouded type

415 V Metal Enclosed Switchgears/ MCC

Sr. No		Description		Technical Particulars
1		**Quantity**		As per Requirement
2		**415 V Switchgear And Busbar Ratings**		
(a)		Rated voltage phase and frequency		415 V, 3 Ph 50 Hz
(b)		System Neutral Earthing		Effectively earthed
(c)		Maximum system voltage		476
(d)		One minute power frequency voltage i) Power circuits		2500
		ii) Control circuits		1500
		iii) Aux. Circuits connected to Sec of CTs		2000
(e)		Continuous current rating of Busbars under site reference Ambient Temperature and type & material		As per the Requirement, AL
(f)		Busbar insulation		Fully insulated encapsulation in epoxy resin with moulded caps protecting all joints
(g)		Reference Ambient Temperature		45

Sr. No		Description			Technical Particulars
(h)		Maximum Temperature of Busbars, Droppers and current rating under site ambient temperature			85° C for bus bars and non silver plated joints 100° C for silver plated joints
(i)		Short Circuit current withstand for Busbars and droppers (i) Short time 1 sec			As per SLD & specs 50kA
		(ii) Dynamic Rating			125kA
3		**Switchgear Constructional Requirement**			
(a)		Type of Construction			Single front fixed type
(b)		Thickness of sheet steel (i) Frame, Frame enclosures, doors, covers and partitions			Cold Rolled – 2.0
(c)		Degree of protection			AS PER IS:13947
(d)		Colour finish shade			Interior : Glossy white
					Exterior : Light grey semi glossy Shade 631 of IS-5
(e)		Earthing bus			Copper
					25x6 (*)
		Earthing conductor			GS
					50 x 10 (*)
(g)		Minimum clearances in air of live parts (i) Phase to Phase mm			25.4
		(ii) Phase to Earth mm			19.4
(h)		Cable entry to cubicles			Bottom
4		**Starters**			
(a)		Contactor rated duty			AS PER IS:13947
(b)		Utilisation category			AS PER IS:13947
(c)		Control transformer :			
(d)		Standard applicable			As per Specifications
(e)		Thermal over load relay reset			
5		**Circuit Breakers**			
(a)		Circuit breaker type			Air circuit Breaker
(b)		Voltage, frequency & no. Of phases			415V, 3 PHASE, 4W,50Hz

Sr. No		Description		Technical Particulars
(c)		Rated breaking duty		B-0.3 SEC-MB-3 SEC-MB
(d)		Rated breaking capacity (i) MVA (ii) KA(RMS) at 415V 0.25 p.f.		
(e)		Short circuit withstand current for 1 sec. Duration		50
(f)		Rated making current kA(PEAK)		125
(g)		Type Of Operating Mechanism		Motor wound spring charged
(h)		Minimum No Of Auxiliary Contacts		6 NO + 6 NC
(i)		Standards Applicable		As per specs
6		**MCCB's**		
(a)		Moulded case circuit breakers to be provided. (a) for motor control circuits (b) for other circuits		
(b)		Voltage, frequency & no of Phases		415V, 50Hz, 3PH
(c)		Rated operating duty		O-3MIN-CO-3MIN-CO
(d)		Rated breaking capacity (at 415v 0.25 p.f.) kA(RMS)		50
(e)		Rated making current kA (Peak)		125
(f)		Rated current at site reference ambient temperature		As per Specifications
(g)		On/off operation Manual Remote power operated		Yes Yes
(h)		Releases required Over load inverse time Under voltage		Yes Yes
(i)		Standards applicable		As per Specifications
7		**Instrumentation Transformers**		
(a)		Current transformer (i) Ratio		As per the Requirement
		(ii) Burden VA		As per the Requirement
		(iii) Accuracy Class		1.0
(b)		Voltage transformer		

Sr. No	Description		Technical Particulars
	(i) Ratio		(415V √3) (110V √3)
	(ii) Burden VA		50
	(iii) Accuracy Class		1.0

415 V Power Capacitor and Control Panel

		Description		Technical Particulars
1		**General**		
(a)		Quantity		
(b)		Rated Capacity		As per the Requirement
(c)		Rated voltage		433
(d)		Rated frequency and phases		50 Hz, 3 Phase
(e)		Ambient temperature		45
(f)		Cable gland required		Yes
(g)		Type of cable		1.1kV, XLPE, Al. Conductor
(h)		Size of cable		As per Requirement
(i)		Cable entry		Bottom
2		**Constructional Requirement**		
(a)		Thickness of sheet steel i) Frame, Frame enclosures, doors covers and partition		Cold rolled 2.0
(b)		Degree of protection		IP 54
(c)		Colour finish shade		Interior : Glossy white
				Exterior : Light Grey Semi Glossy Shade 631 of IS 5
(d)		Earthing bus		Copper
				25x6 (*)
(e)		Earthing con duct or		Copper
				40 x 6 mm (*)
3		**Design Requirement**		
(a)		Insulation level		2.5
(b)		Capacitor bank connection		Delta
(c)		Short circuit withstand for busbars i) Short time (1 sec)		As per SLD & specifications

		Description		Technical Particulars
		ii) Dynamic		87.5
(d)		Type of switching		Automatic switching responsive to power factor through power factor sensing relay
(e)		Switching steps		Minimum 8 steps
(f)		Rating of contactor		To suit KVAR unit
(g)		Incomer switch current rating		To suit rated capacity of KVAR
(h)		Busbars		Copper

Battery

		Description		Technical Particulars
1		Application		Control, annunciation and emergency lights
2		Type of battery		Ni-Cd
3		Number of battery banks required		As per requirement (*)
4		Ambient conditions		Min. Temp. 25˚ C
				Max. Temp 45˚ C
5		D.C. system voltage V		110
6		Ampere hour capacity of battery at 27 Deg. C at 10 hour rate to give final cell voltage of 1.75 volts/cell Ah		As per the Requirement
7		Momentary load/duration A		To be furnished by the Bidder
8		Emergency load/duration A		To be furnished by the Bidder
9		Continuous load/duration A		To be furnished by the Bidder
10		Cell voltage - initial/final V		1.42/1.14 V
11		Mounting arrangement		Multi tier
12		Charging method proposed		Float cum boost charging

Battery Charger and D.C. Distribution Board

		Description		Technical Particulars
		General		
(a)		Number required (i) Battery charger Nos.		As per the Requirement (*)

		Description			**Technical Particulars**
		(ii) D.C. Distribution board		Nos.	As per the Requirement (*)
(b)		DC System Voltage (Nominal)		V	110
(c)		DC System Earthing			Unearthed
(d)		Ambient Design Temperature		Deg. C	45˚ C
(e)		Busbar material & size		-	Copper , size as per Requirement
		DC Bus Load			
(a)		Total continuous DC load		A	
(b)		Short time loads (Additional to continuous loads)			
		(i) DC lights/Facia lamps		A	
		(ii) Starting current and duration		A	
		of Largest Connected DC Motor		Secs	
		Battery Details			
(a)		Float/Trickle charging current of battery		mA	As per manufacturer
(b)		Boost Charging Current of Battery (Maximum)		A	As per manufacturer
(c)		Boost Charging Voltage of Battery (maximum)		V	As per manufacturer
(d)		Maximum Time for Boost charging of Battery		hr	As per manufacturer
(e)		Battery capacity & no. of cells		Ah	As per the Requirement (*)
				Nos.	As per the Requirement (*)
		AC System Data			
(a)		Supply	Voltage	V	415
			Phase		3
(b)		(i) Variation in supply Voltage		%	± 10
		(ii) Variation in supply frequency		%	± 5
(c)		Short Circuit level		kA	35
(d)		Type of earthing			Solidly Earthed
		Performance			
(a)		DC voltage setting			±10% of nominal voltage

		Description			**Technical Particulars**
		adjustment for float charger			
(b)		Voltage stabilisation for constant voltage regulator			±1% of set D.C. voltage, with AC input variation and DC load variation from 0 to 100%
(c)		Maximum permissible variation in DC voltage (no load to full load)			± 1%
(d)		D.C. voltage setting adjustment for boost charging			70% to 100% of max. boost charging voltage
(e)		D.C. current adjustment for boost Charging			30% to 100% of max. boost charging current
(f)		Current stabilisation for constant current regulator for boost charger			± 2%
(g)		Minimum permissible power factor to rated continuous load			0.8
(h)		Permissible ripple content at rated continuous load			3% (maximum)
		Miscellaneous			
(a)		Constructional Features for Battery Charger & D.C. Distribution Board			
		(i) Thickness of sheet steel Frame, Frame enclosures, doors, covers and partition			Cold rolled 2.0
		(ii) Degree of protection			IP 42
		(iii) Colour finish shade			Interior: Glossy white
					Exterior: Light Grey Semi Glossy Shade 631 of IS 5
		(iv) Earthing bus			Copper
					25 x 6(*)
		(v) Earthing conductor			GS

		Description		Technical Particulars
				40 x 6(*)
(b)		Cable entry		Bottom
(c)		Cable Sizes (i) Battery		As per the Requirement
		(ii) DC output		As per the Requirement
		(iii) AC input		As per the Requirement
(d)		Relay for auto changeover from Float to boost mode to be provided (in case of float-cum-boost charger)		Yes

Cables: HV, LV, Control and Telecommunication

	Description	Unit	Technical Particulars
(a)	11 kV earthed Aluminium Conductor XLPE, armoured power cable		As per IS 7098
(b)	650/1100 V grade PVC insulated Aluminium conductor armoured power cable (AYWY or AYFY)		As per IS 1554
(c)	650/1100 V grade XLPE insulated Aluminium conductor armoured power cable		As per IS 7098
(d)	650/1100 V grade PVC insulated copper conductor armoured control cable		As per IS 1554
(e)	Telecommunication cables		As per IS 10579 IS 5801 IS 9943
(f)	Epoxy Heat Shrinkable Straight through joints and end terminations.		

Lighting Fixtures and Accessories

1		General		
	(a)	Normal Supply Voltage, Phase and Frequency	AC DC	230V, 1PH, 50Hz
	(b)	Variation in Supply		
		i) Voltage	%	+10%
		ii) Frequency	%	+5%
		iii)Combined voltage & frequency	%	+10%
	(c)	Design Ambient Air	°C	45

		Temperature		
	(d)	Luminaire Terminal Suitable for		
2		Indoor non hazardous area		
	(a)	Conductor material		COPPER
	(b)	Wire size Cores x s		4C x 2.5 Sq.mm
1.4.2		Indoor hazardous / Outdoor area		
	(a)	Conductor material		ALUMINIUM
	(b)	Cable size Cores x sq.		4C x 16 Sq.mm
1.5		Luminaire Earthing Terminal Suitable for		
		a) Conductor material		GI
		b) Conductor size SWG		12

Lighting System and Equipment

Sr. No.		Description	Unit	Technical particulars
1		**System particular**		
(a)		**Voltage**		
(i)		3 phase, 4 wire 50 HZ System		
		Rated	V	415
		Maximum	V	476
		One minute withstand Voltage		2000V
(ii)		D.C. System		
		Rated	V	110
(b)		System short-circuit level		
(i)		at 415 V, A.C.	KA (rms)	10
(ii)		at 110 V.D.C	KA (D.C)	6
(c)		Reference ambient temperature	^{0} C	45
2		**Distribution board/panels**		
(a)		Main, floor mounted distribution boards		As per the Requirement (*)
(i)		Main lighting distribution board(A.C)		As per Specifications (Part 6: General Requirements – Electrical Equipment)
		Make		

Sr. No.	Description	Unit	Technical particulars
	Type		
	Degree of protection		
	Bus bar material		Copper
	Bus bar current rating	A	
	Short circuit current rating	KA	10
	Details of incoming and outgoing feeders		
	Cable entry		Bottom
	Location		Indoor
(ii)	Emergency lighting panel (DC)		Not applicable
	• Make		
	• Type		
	• Degree of protection		
	• Bus bar material		
	• Bus bar current rating	A	
	• Short circuit current rating	KA	
	• Details of incoming and outgoing feeders		
	• Cable entry		
	• Location		
(iii)	Single/three phase DBs, wall/structure mounting		As per Specifications (Part 6: General Requirements – Electrical Equipment)
	SLDB/TLDB for indoor area		
	• Make		
	• Type		
	• Details of incoming and outgoing feeders		
	• Degree of protection		
(iv)	Single/three phase DBs for outdoor area		As per Specifications (Part 6: General Requirements – Electrical Equipment)
	• Make		
	• Type		
	• Details of incoming and Outgoing feeders		
	• Degree of protection		
(v)	Paint finish		

Sr. No.		Description	Unit		Technical particulars
		(i) Colour shade:			Interior : Glossy white Exterior: Light gray semi glossy shade 631 of IS:5
3		**Street light poles and flood light poles**			As per Specifications (Part 6: General Requirements – Electrical Equipment)
(a)		Street light pole			
		Type			
		Total height:	M		9.0
		Quantity:	Nos.		As per the Requirement (*)
(b)		Floodlight light pole			
		Type			
		Total height :	M		30
		Quantity:	Nos.		As per the Requirement (*)
		No. of floodlights to be fixed per pole	No.		

Lighting system Installation Work

		Description		Technical Particulars
1		**Installation of Earthing Conductor**		
(a)		Indoor Areas		
		(i) Size		12 (*)
		(ii) Material		G.S. wire
(b)		Outdoor Areas		
		(i) Size		8 (*)
		(ii) Material		G.S. wire
2		**Installation of Conduits**		
(a)		Rigid		
		(i) Material		Galvanised steel
		(ii) Sizes		20 (*)
3		**Installation of Wires/Cables**		
(a)		1100 V, 1 Core, PVC Insulated Wires		
		(i) Conductor material		Copper
		(ii) Size		Lighting 1Cx1.5(*) Receptacles 1Cx2.5(*)
		(iii) Colour Coded ‘Black’		
(b)		(iv) Colour Coded ‘White’ 1100 V, PVC Insulated PVC Sheathed Armoured Cable		

		Description		**Technical Particulars**
(c)		Size & cores		2C X 4 and 2C X 6
				4C X 6
4		Contractor shall route and supply these items as required.		
5		Supply of earthing conductors, mounting accessories and all fixing hardware are included as part of the installation work.		
6		Supply of conduits and wires/cables and all fixing hardware are included as a part of installation work.		

Earthing and Lightning Protection System

Sr. No.		**Description**	**Technical particulars**		
			Size	**Material**	**No. of Leads & quantity**
1		**Main earthing grid**	a) Size & Material: As per Specifications (Part 6: General Requirements – Electrical Equipment) b) Quantity as per requirement (*) c) Min. No. Of Leads shall be 2 for 3-Ph & 1 for 1-Ph. d) Min. Requirement & additional earth pits shall be made such as to maintain Grid values 1 Ohm. e) For Transformer & DG Neutral – 2 Nos. each independent.		
(a)		Buried in earth			
(b)		Buried in floor slabs in buildings			
2		**Conductor leads to equipment** (above ground)			
(a)		Transformers			
(i)		Transformer neutral to bottom of tank			
(ii)		From bottom of tank to earth grid			
(iii)		Transformer tanks and radiator bank			
(b)		Diesel & Bio Gas generator set			
(i)		Neutral earthing			
(ii)		Body earthing			
(c)		Fence posts and gates (flex. braid)			
3		11 KV metal enclosed switchboard, 415V switchgear/ MCC.			
4		**Motors**			
(a)		415V motors above 10 KW			
(b)		415V motors up to 10 KW			
(c)		Fractional Horse Power motors			

Sr. No.		Description	Technical particulars
5		**Other items**	
(a)		Capacitor panel, battery charger panel, dc distribution board , Main Lighting DB, control panels and sub-lighting distribution boards etc	
(b)		Hand rails	
(c)		Cable trays	
(d)		Tanks	
(e)		Junction boxes	
(f)		Lighting fixtures, receptacles, lighting conduits	
(g)		Push button stations, limit switches	
6		**Crane rail**	
7		Street lighting, flood lighting poles and junctions boxes	
8		Metallic noncurrent carrying structures	
9		**Lightning conductors**	
(a)		Lightning protection down comers for building	
(b)		Lightning protection horizontal roof conductor for building	
10		**Electrodes**	
(a)		Pipe/Rod Electrode	
(b)		Plate Electrode	

Control & Relay Panel

Sr. No.		Description	Technical Particulars
(a)		Control / Relay panel designation	
(b)		Type : Simplex / Duplex /Mosaic/Panel cum Desk	Simplex
(c)		Cold rolled sheet steel thickness	Frame – 3 mm thick
(d)			3 mm (min.)

		(i) Front and rear (ii) Sides, top and bottom	2 mm for sides, 3 mm thick Gland plates
(e)		Painting (i) Finish Enamel/Epoxy (ii) Colour Shade to IS 5.	RAL 7032
(f)		Cable Entry - Top / Bottom	Bottom
(g)		Mimic Bus colour (If required) for different voltages.	Screw on type painted aluminum strip of 12 mm x 3 mm thick
(h)		Earth bus material and size, inside the panel.	25 mm x 3 mm tinned Copper (minimum)
(i)		Degree of protection	IP 54
(j)		Auxiliary voltages to panels a) AC DC	240 V AC 1 phase 110 V DC (dual feed)

Note:

(i) Any requirement/ features/ provisions not specifically mentioned in the Specification, but are necessary for trouble free and smooth operation of the Plant System shall be included.

(ii) (*) – The numbers, ratings, sizes etc. have to be worked out by the contractor during execution and to be approved by the Engineer.